

ROCKS and MINERALS

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PETER ZODAC

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ROCKS and MINERALS

PEEKSKILL, N. Y., U. S. A.

The official Journal of the Rocks and Minerals Association

Chips from the Quarry

WM. C. CHANDLER, AN ARDENT BOOSTER OF THE R. & M. A.

Wm. C. Chandler, of San Jose, Calif., is one of R. & M. A. most ardent boosters. During September of this year he has obtained for the Association six new members and has promised to obtain more before the year is out.

Mr. Chandler is also an ardent collector and lapidary. During the months of September and October he has had on display, in the Rosicrucian Museum in his city, a collection of lapidary work illustrating the methods used in cutting, shaping, and polishing minerals and gems. The specimens shown range from rough then through all stages up to highly polished. The equipment used to work the minerals is also shown. Practically all minerals exhibited are from California localities, many from the San Jose area.

This very interesting and most instructive exhibit had attracted so much attention that though it was to be held during September only, Mr. Chandler was persuaded to let it remain throughout October—and perhaps it may run also through November. The *San Jose Evening News*, in its issue of Wed., Sept. 15, 1943, had a most interesting write-up on the exhibit including a very nice picture of Mr. Chandler in his lapidary shop. The interest in the exhibit seems to be increasing daily.

There is at present so much interest in minerals in San Jose (due greatly to the exhibit) that Mr. Chandler is desirous of forming a mineral club to be affiliated with the R. & M. A. His ideal for the club is 100% membership in the Association. Another feature of the club, that is dear to his heart, is for each member to sponsor some boy or girl who is keenly interested in minerals.

Those of our readers residing in or near San Jose who would like to meet Mr. Chandler and join his proposed club are urged to do so. His address is 944 University, San Jose 11, Calif.



Just as we were about to go to press, a letter from Mr. Chandler arrived to inform us that the club has been formed and that meetings will be held in the Rosicrucian Science Building Lecture Room. A 100% membership in the R. & M. A. was unanimously approved by the members.

Peter Zodac

*Buy War Bonds and Stamps
Safest Investment on Earth*

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((The Official Journal
of the
ROCKS and MINERALS
ASSOCIATION))

Whole No. 148

SOME MINERALS OF NEBRASKA

By PROFESSOR E. F. SCHRAMM

Chairman Department of Geology
University of Nebraska

As you probably know, Nebraska is noted for its scarcity of fine gem minerals and perfect crystals. This is due in large part to the fact that there are no igneous or metamorphic rocks in place, exposed at or occurring near the surface.

The entire state is covered with sedimentary formations consisting of limestones, sandstones and shales much of which are mantled with loess, glacial drift, and the so-called "Sand Hills".

The limestone of Pennsylvanian age in the quarries east and west of Louisville, Nebraska, and just east of Weeping Water contain some small pieces of pyrite and some more or less nodular masses of marcasite, but not of the cabinet specimen type.

The limestone of Permian age, well exposed in the C. H. Davis quarry about two miles east of Wymore, Gage County, Nebraska, contains many geodes which are lined with small quartz and calcite crystals. They represent some of the finest quartz crystals found in the state.

Small barite crystals occur in large numbers in the mottled clays exposed about 4 miles south west of Odell, Gage County, Nebraska. This barite occurs as flat, rhomboidal pink to yellowish colored crystals, usually varying in size from $\frac{1}{8}$ to $\frac{1}{4}$ inch in diameter. When viewed by transmitted light they show the so-called phantom figures.

A few small crystals of celestite have been found in geodal cavities in lime-

stones near Wymore and Holmesville, in Gage County. Similar crystals of celestite have been collected in the "Bad Lands" region of northwestern Nebraska.

Some very nice specimens of bluish gray translucent chalcedony occurs in numerous veins cutting an isolated outlier known as Sugar Loaf Butte, located about one and a half miles east of Orella, Sioux County, Nebraska. This type of chalcedony is also common in the Little Bad Lands in northern Sioux County, north west of Crawford and south of Orella.

An extremely interesting type of chalcedony geode is found in the Cretaceous shales of northern Dawes County, Nebraska. The largest of these geodes are about eight to nine inches long and five inches wide at the center and the cavities of the geodes are completely filled with clear transparent selenite. One locality in which these specimens are found is located about 16 miles due north of Crawford, and the other approximately 15 miles northeast of Chadron near the Nebraska-South Dakota state line.

Calcite and aragonite occur to some extent along joint planes in limestones of Pennsylvanian age, in the quarries near Louisville, Weeping Water, and Snyerville, in Cass County. The Permian limestone quarries near Roca, Wymore, and Blue Springs in this state also contain some calcite crystals and fibrous crusts of aragonite usually found along joint or stratification planes.

Some pink calcite occurs in limy shales of Permian age in a prominent exposure located about one mile east of Bennett, Nebraska, along the south bank of the Little Nemaha River. This is also an excellent collecting ground for invertebrate fossils of Permian age.

Quartz, magnetite, and garnet sand are found in a more or less intimate mixture in thin lenses in rocks of Tertiary age in a number of places in Sioux, Morrill, Scotts Bluff, Banner, Kimball and Cheyenne counties, Nebraska.

Manganese dioxide in the form of pyrolusite is rather widely distributed in the limestones, clays, and sands of the state but not in large quantities. A massive to earthy type of pyrolusite occurs in joint planes in an exposure of the Niobrara limestone along the Missouri River, due north of Ponca, Nebraska. Pyrolusite with a radiating structure occurs in concretionary nodules about two inches in diameter in Cheyenne County. Occasional pieces of Pennsylvanian limestone show dendritic or arborescent oxide of manganese markings along the stratification planes of the stone.

A low grade of limonite is the principal coloring agent of the Dakota Cretaceous sandstone which outcrops extensively in the eastern part of Nebraska. Fine exposures of this formation are found southeast of Ashland on both sides of the Platte River. Fossil leaves are common in this formation and such stone is widely used for decorative purposes in rock gardens.

Ochre has been reported from a number of localities, particularly from Indianola in Red Willow County.

Selenite crystals, one to five inches in length, occur commonly in the Graneros, Carlile, and Pierre shales of Cretaceous age. Good exposures of these shales can be found along the Republican River from Nuckolls to Dundey counties, also along the Niobrara and Missouri rivers in the northeastern part of the state from Keya Paha to Dixon counties. Selenite-bearing Pierre shale can also be found in northern Sioux and Dawes counties in the extreme northwestern corner of the state.

Small amounts of earthy melanterite have been noted in these same shales in areas where the selenite is fairly abundant.

Thin layers of bentonite are occasionally found in the Graneros, Carlile, and Pierre shales, but not in commercial quantities, such as occurs at Upton, Wyoming. Bentonite when pure is a greenish-yellow to whitish-yellow plastic clay with a waxy lustre. It is noted for its colloidal properties and its unusual absorbent qualities. A good grade of bentonite will absorb about seven times its own volume of water. Bentonite is thought to be an alteration product of volcanic ash.

With the exception of the oil producing formations in Richardson County, the only minerals of commercial value in Nebraska are quartz gravels, found along the Platte River and some of its tributaries; volcanic ash which is found in every county in the state and a few deposits of diatomaceous earth.

Members of the Nebraska Mineral and Gem Club frequently visit the gravel pits near Louisville and Fremont, both located on the Platte River, to collect semi-precious gem size varieties of quartz. The following varieties of quartz are rather common at these pits, namely: red, brown, mottled and variegated jaspers, milky quartz, occasional pieces of carnelian, chalcedony, flint, hornstone, chrysoprase, basanite, petrified wood, and agate. Large "float" pebbles of similar varieties of quartz are found in many places in northern Sioux and Dawes counties. Petrified wood is common throughout the state, being usually found in small pieces in gravel pits.

There are on exhibit in the Nebraska State Museum two large silicified stumps collected from Pliocene sediments in Cherry County, Nebraska. One of these logs is about 4 feet long and two and a half or three feet wide. The logs are black in cross section with a thin white siliceous veneer on the outside.

Moss agate occurs in place on the ranch of Harold J. Cook at Agate, Nebraska. Beautiful arborescent and mossy inclusions occur in transparent chal-

cedony with some specimens having a reddish or brownish color.

Volcanic ash or "Pumicite" is widely distributed in Nebraska. Commercial deposits of this material have been mined by the open cut method at Orleans, Harlan County; at Ingham, in Lincoln County; near Edison in Furnas County; at Endicott in Jefferson County and three miles north of Royal in Antelope County, Nebraska. Volcanic ash is used extensively as a scouring and cleansing powder.

Dr. E. H. Barbour has described this volcanic ash in detail in a report entitled "Nebraska Pumicite", Vol. 4, Part 27 of the Nebraska Geological Survey. In this report he describes the Ingham deposit as having a thickness of 25 feet and the Edison mines as containing beds of pumicite varying from 8 to 17 feet thick; the Orleans deposit is described as having a thickness of 10 feet. An undeveloped deposit three miles north of Royal, Antelope County, Nebraska has been prospected to a depth of 28 feet.

Volcanic ash has been reported from practically every county in the state, many of the deposits being extremely pure, while others are mixed with loess and other silt producing formations.

Diatomaceous earth, another pulverulent, earthy material, frequently found with volcanic ash, has been discovered in comparatively pure thick deposits in a number of counties in the state. According to the Nebraska Geological Survey Volume 3 by Barbour, diatomaceous earth has been discovered in Wheeler, Hooker, Thomas, Blaine, Garfield, Greeley, Valley, Sherman, Nance and Sioux counties, Nebraska. C. J. Elmore recognized and described 80 distinct species of fossil diatoms from the localities above mentioned. These scattered deposits vary in thickness from 18 inches to 10 feet. The Thomas County deposit has a maximum thickness of five feet. The Sioux County deposit of Miocene age, has been described as 10 feet thick.

Fulgurites of interest to collectors have been found in the Sand Hills region of Nebraska. Fulgurites, or "lightning tubes" as they are sometimes called,

are formed by lightning striking wet deposits of quartz sand, fusing it instantly into the form of a rough corrugated tube with a glassy texture on the inside of the tube, with partially fused particles of sand sticking to the hackley outside surface.

The Nebraska State Museum at the University of Nebraska, has on exhibit a particularly fine forked fulgurite from Stanton County, which has a maximum diameter of about 3 inches and a length of 10 feet. This specimen was discovered, collected and donated to the Museum by Oscar E. Hans in 1909. Some fine specimens have also been collected in Holt and Madison counties. The Stanton and Holt county fulgurites have been described in detail by Dr. E. H. Barbour of the Nebraska State Museum and A. E. Anderson of the American Museum of Natural History, in bulletins 6 and 7, Volume I of The Nebraska State Museum.

Other specimens found in the state, of interest to collectors, consist of fossil bird and turtle eggs, silicified hackberry seed cemented together to form a conglomerate, and fossil chalcedony hickory nuts, all found in rocks of Tertiary age in the western part of Nebraska. Fine specimens of hackberry conglomerate have been collected in Custer, Cherry, Sioux and Dawes counties. Some of the choicest specimens of hackberry conglomerate are found in rocks of Miocene age.

The chalcedony hickory nuts showing the configuration of the meaty surface of the nuts are found in rocks of Oligocene age in Sioux County, Nebraska. They were first collected by Dr. E. H. Barbour and described by him in the Proceedings of the Nebraska Academy of Science in December, 1896.

In the southeastern part of the state in formations of Pennsylvanian and Permian age we find some limestone beds which are composed almost entirely of Fusulinidae, a type of Foraminifera which collectors recognize as being about the size of grains of wheat or rice, hence the name "wheat stone or rice stone". Some of these specimens are sufficiently

hard to take a beautiful polish, when cut in cabochon form. A green quartzite occurring well exposed near Franklin, Nebraska, also takes an excellent polish and makes an interesting addition to a cabochon cut collection of semi-precious stones.

Meteorites have been found in 26 counties of the state, namely in Douglas, Lancaster, York, Franklin, Phelps, Kearney, Lincoln, Frontier, Red Willow, Hitchcock, Hayes, Howard, Valley, Custer, McPherson, Keith, Grant, Cherry, Brown, Rock, Boyd, Dawes, Sioux, Scotts Bluff, Kimball and Cheyenne.

As a collecting ground Nebraska is noted particularly for the large number and variety of fossilized mammalian skeletons found in the state. All of the larger and many of the smaller museums in America have had collecting parties in the state. The Nebraska State Museum has one of the finest collections of fossil mammals in America. Collecting parties have been sent out over the state from this institution year after year since 1891.

Some unusually interesting barite concretions, described as "barite dollars" because of their shape are found in the Graneros shale of Cretaceous age, just south of Bloomington, Franklin County, Nebraska, along the Republican River.

These barite concretions were first discovered, recognized and described by Dr. E. H. Barbour in 1910 and later de-

scribed in more detail by J. B. Burnett in 1916. His paper on "Barite Dollars" from Franklin County is published in Volume 7, Part 15, of the Nebraska Geological Survey. These specimens are about the size and shape of a silver dollar and contain approximately 90% of barium sulphate and 8% of hydrated ferric oxide with minor quantities of silica, and water, and a trace of alumina and manganese. Some of the concretions are round, others disc shape and have a dark gray color with a hardness of 2.5 and a specific gravity varying from 4.05 to 4.22.

"Septaria like concretions" containing small crystals of pyrite, marcasite, and barite occur in the Dakota clays of Cretaceous age at the "Burnham" or Yankee Hill Brick yard clay pit near Lincoln, just south of Pioneers Park. The concretions are found at two levels in some abundance, the upper layer occurring just below five feet of massive brown sandstone, while the lower stratum occurs about 25 feet lower in the section. These concretions have been described by J. B. Burnett in Volume 7, Part 16, of the Nebraska Geological Survey.

In writing for any of the publications mentioned in this article address your communications to Dr. C. B. Schultz, Director of the Nebraska State Museum, University of Nebraska, Lincoln, Nebraska.

EYLES MOVES TO COLORADO

Wilfred C. Eyles, one of the best known manufacturers of diamond saws in America, has moved from 2794 "A" St., Hayward, Calif., to Bayfield, Colo. Mr. Eyles, a member of the R. & M. A. for many years, is also known as an ardent mineral collector. One of his most interesting trips was written up for the Feb. 1938 issue of ROCKS AND MINERALS, and the Editor has been the

recipient of many choice specimens collected by him.

Our best wishes are extended to Mr. Eyles and we hope that his new location—in an area where fine minerals abound—will bring him even more business than he had ever hoped to receive. And may his many mineral trips to come always reward him with outstanding finds of choice specimens.

Some Features Suspended

During the past few months ROCKS AND MINERALS has received so many articles that were contributed by readers that in order to

print them all we must suspend for the time being some of the regular features of the magazine.

STILBITE AT WATERTOWN, CONN.

By PETER ZODAC

Returning from a business trip to Westfield, Mass., some few weeks ago, we chanced to notice an unusually white patch to the left of the road on the outskirts of Watertown, Conn. We stopped the car, turned around, and went back to investigate. The white patch turned out to be stilbite, completely coating the face of a rock cut that was 15 ft. long and 8 ft. high.

Watertown is a pretty village of about 6,000 population in the western part of Connecticut (in S. E. Litchfield Co.). It is the home of Taft School, a famous school for boys. U. S. Route 6 passes through the village.

The stilbite occurrence is on Porter Street which runs east off Cutler Street (Route 6), exactly one mile northeast from Taft School (main entrance). At the time of our visit, Porter Street had but recently been graded and macadamized—apparently it had also been widened as the rock exposure on its north side looked very fresh. There is no rock on the south side. We had been through Watertown many times before but never noticed the white patch which may be another indication that the cut may be a recent one.

The rock begins to outcrop 150 ft. from Cutler Street (right alongside a small garage). For the first 15 feet it is mica schist (8 feet high); then pegmatite (25 feet long and 12 feet high); and again mica schist (15 feet long and perhaps 10 feet high). The pegmatite is a dike cutting right through the center of the mica schist. Stilbite coats the entire face of the first mica schist, a small part of the pegmatite, and apparently none of the second mica schist. In macadamizing the road, much of the asphalt splattered on the face of the rock cut. Tiny black dots of asphalt may be

noted 5 feet above the ground increasing gradually downward until near the ground they are quite large.

Mineralogy

The following minerals were noted in the rock cut:

Albite: white, as a constituent of the pegmatite.

Biotite: black flakes associated with muscovite in pegmatite.

Garnet (Almandine): tiny red grains and crystals in pegmatite; one nice one was imbedded in muscovite.

Limonite: brown stains on rock.

Montmorillonite: pale pinkish earthy masses coating walls of tiny cavities in pegmatite—often imbedded in stilbite—appears to be montmorillonite even though at times its hardness seems to be 5 or more; this hardness may be due to underlying albite or other hard mineral.

Muscovite: white flakes associated with biotite in pegmatite; also as a constituent of mica schist.

Quartz (Smoky): massive, as a constituent of pegmatite.

Stilbite: white, radiating masses coating the entire face of the first mica schist exposure and even some of the pegmatite. Unfortunately the stilbite is not of very good quality—often it is stained brown by limonite. However, if a collector were to reach the locality in the daytime and did some scouting around he might collect some good specimens. We were there in the early evening and have not been back since.

WARNING: collectors planning to visit this locality are warned not to have the asphalt fool them. Black minerals resembling tourmaline, hornblende, magnetite, etc., may be nothing more than hardened splattered asphalt. Test it with your knife!

If Your Magazine Fails to Arrive . . . !

Do not worry. It will show up in due time. The post offices are overtaxed with work so that it is impossible for them to give

you standard service. Many magazines are now reaching subscribers two and three weeks late.

A MINERAL DINNER

By MRS. EDITH McLEOD

413 High St., Klamath Falls, Ore.

I recently served a "mineral dinner" at a meeting of the Klamath Mineral Club, and it really 'took', the nice part of it being that I still have the food, the guests seeming to prefer the ice cream and cake which our hostess served later in the evening. The fact that my food was not eaten was probably due more to the scarcity of dentists during this war and the necessity of conserving our teeth rather than lack of appreciation.

A dining room table was covered with a luncheon cloth. In the foreground was set a china plate and reposing on it was a nice slice of ham (a cut slab of Argentine rhodochrosite, "Inca Rose"). On either side of the plate was the customary knife, fork and spoon and a paper napkin. The rest of the "food" was served on paper plates and saucers, with a large placard in the back labeled "If Worst Comes to Worst We Can Still Eat Minerals", and by each plate or saucer was a smaller card bearing the name of the food and in smaller print at the bottom the real name of the mineral specimen.

In a sugar bowl was a week's ration of sugar—white quartz sand from Klondike, Missouri. In glass salt and pepper shakers were white pepper—crysolite sand from Tule Lake, Siskiyou County, California—and black pepper—magnetite sand from Algoma Point, 12 miles north of this city. Among the meats, besides the ham, were stew meat (chunks of cinnabar, the fat being the matrix of calcite and opalite); bacon (red and white banded travertine from California); kidney (a mammillary piece of red jasper from Dry Creek, Lake County, Oregon); clams were petrified clams from Ocean Park, Oregon; shrimps were small curled petrified ammonites from Texas; and on a saucer reposed a Japanese shell, *murex tenuispina*, skeleton-like, spiny thing very much resembling the skeleton of a fish. On this card I simply wrote, "Sorry—I ate the rest", with the real name of the

specimen down at the bottom. A piece of pinkish-red pebbly travertine was a crab—as props to help out the illusion were claws cut from cardboard and painted the proper crab color. A perfect resemblance of a chicken gizzard was the agate center of a thunder egg, the matrix having completely weathered away. This specimen was given me by Mr. Brown of New Pine Creek, Lake County, Oregon, who has a large collection of thunder egg agates.

Among the vegetables were a baked potato (concretion from Nut Hill, Washoe County, Nevada); mashed potatoes (diatomite from Pitt River, California); cauliflower was a "cauliflower"—calcareous tufa formation—from Duck Lake, Nevada; mushrooms were small unopened "cauliflowers" from the same region; navy beans were loose pisolite concretions from Pyramid Lake, Nevada.

In the line of dessert were two kinds of cake. One was a dark and light cake (white layers of quartz with a dark layer of jasper in between, from the Bay of Fundy, Nova Scotia, presented to me by Mr. W. B. Yates of this city); the other was a wedge shaped cut of banded agate from Clear Lake, California, presented to me by Mr. R. D. Tweedie of Oakland, California. Also had mint jello with marshmallows in it—that green glass containing wollastonite crystals that some energetic person or persons was trying to pass off as green obsidian some time ago. However I have it in my mineral collection as nature made the wollastonite, not man, and it is interesting. Lemon pie filling (with the label, "I did not have time to make the crust") was fluorescent opal from Virgin Valley, Nevada, and greenish-yellow translucent chalcedony from the top of Hart Mountain, Lake County, Oregon. Cake frosting was a crust of pure white glistening frosty looking quartz from the ocean coast near Brookings, Oregon, given me by Judge D. V. Kuykendall of this city. Cinna-

mon roll was half of a cut thunder egg kindly sent me by Mr. V. C. Cutler of Long Beach, California, showing markings that clearly suggest just that—a cinnamon roll. An ice cream cone was another Duck Lake calcareous tufa formation, a nice cone with a larger round blob of ice cream in it, a little dirty looking for ice cream it is true, but where is your imagination?

And even if it is war time I had several kinds of candy. Marshmallows carved from diatomite and so realistic looking that mother put out her hand to take one to eat when she saw them on the table here at home. Licorice drops (obsidian pellets from Little High Rock Lake, Nevada); old fashioned licorice sticks (petrified charred willow sticks from a cut on highway number 99, a few miles south of Ashland, Oregon); sections of licorice whips were slender dark tourmalines from Brazil; stick candy was stalactites from Mammoth Cave (col-

lected long ago by somebody else, not I) and other caves. And let me say right here that I never break off stalactites or stalagmites. I am not a cave vandal.

For fruit we had pine-apple and grapes. Pine-apple was a formation from Duck Lake, Nevada, again—very versatile, those formations of calcareous tufa. Grapes were of the Concord variety (black nicely shaped botryoidal specimen of hollandite, with three or four hollandite marbles added to the bottom of the specimen to form a nicely shaped bunch of grapes. This mineral is from Virgin Valley, Nevada.

Flour was English coating clay (powder); nuts were concretions from Nut Hill, Nevada; honey was a honey colored calcite from the Marble Mountain Quarry, Josephine County, Oregon, kindly given me by Venita Daley of Medford, Oregon, and amber from Germany given to me by Mr. K. M. C. Neill of Grants Pass, Oregon. In an iron



A tempting "Mineral Dinner" but where are the guests?

skillet lay three flat round basalt Indian artifacts labeled "pancakes, slightly overdone", and in a bread tin were two loaves of bread, "also slightly overdone" (Indian grinders in the perfect shape of loaves of bread). Received a razzing about not being able to cook without burning. In a small glass tub was a little brown bottle surrounded by cracked ice ("Herkimer diamonds"), which were sent to me in exchange by the late Joseph N. Prokes of Jackson, Minnesota. Amphibole, variety mountain leather makes a good wasp's nest imitation so that was included and labeled "Chinese eat birds' nests so why can't we eat wasp's nests?" And in a soap dish lay a pinkish stone Indian grinder shaped for all the world like a large cake of that highly scented cheap soap which one sometimes sees in wire baskets in grocery stores. I labeled that "Wash up before you eat".

Most of the above minerals (except those where the donors' names are mentioned) we have collected in the course

of our many pre-war trips in southern Oregon, northern California and northern Nevada. Some we bought from dealers.

I have extra of the mashed potatoes, licorice drops, white pepper, nuts, cauliflower, mushrooms, and marshmallows (carve your own) in case some of you readers would like build up a collection of edibles; would be glad to exchange.

Look over your collection and see how many foods you can find. Try it out at your next club meeting but don't draw too heavily on the members' imaginations. Remember some folks do not have much imagination. Be sure that the resemblance is good or do not use it. A bit of fun helps a lot in these days.

"Laugh and the world laughs with you;
Weep and you weep alone,
For this sad old earth
Has need for it's mirth

But has trouble enough of it's own".

Emma Wheeler Wilcox.

NOTES ON THE DETERMINATION OF THE POSITIVE AND/OR NEGATIVE RHOMBOHEDRON FACES OF QUARTZ CRYSTALS

By O. IVAN LEE

Jersey City, N. J.

Of the three methods now in use for the fabrication of quartz oscillators from quartz crystals, the Z section method, the X section method and the direct wafering method, most manufacturers now using the last procedure require crystals having at least one recognizable and useful cap or pyramid face, unless X-ray apparatus and a suitable technique are employed.

Quartz oscillators must maintain and monitor their assigned radio frequencies (wave lengths) for which they were designed and dimensioned over wide extremes of temperature, usually -30° F. to $+130^{\circ}$ F., that is, they must have nearly zero temperature coefficients within this range. By experiment and calculation, it has been found that this vital specification

may be met in a variety of ways by cutting the oscillators exactly (usually within $15'$) to certain angles with respect to the Z or crystal axis, at the same time maintaining two way parallelism to a selected X axis (corner to corner and normal to Z).

In one system of cutting wafers, advantage is taken of the fact that the cap or pyramid angle of quartz is constant ($38^{\circ}14'$). An important oscillator type known as the BT cut, is just -49° from the Z axis, hence, if $10^{\circ}46'$ ($49^{\circ}-38^{\circ}14'$) is ground and lapped from an r (A) face, simultaneously maintaining parallelism with the growth lines of the corresponding m (E or F) prism face, and the crystal then set up for sawing with this lapped face parallel to the diamond

saw, the resultant wafers will be at the correct BT angle.

In practice, the lapidary laps the r (A) face until it subtends an angle of exactly $87^{\circ}14'$ ($49^{\circ} + 38^{\circ}14'$) with the opposite or reference z (B) face. Similarly, if a type AT cut is wanted ($+35^{\circ}$ from Z), a selected z (B) face is lapped until it makes an angle of exactly $73^{\circ}14'$ ($35^{\circ} + 38^{\circ}14'$) with the opposite or reference r (A) face, maintaining parallelism with the growth lines as before.

Lacking suitable X-ray equipment, these important positive r (A) or negative z (B) rhombohedral faces can be identified with certainty by:

I. The joint utilization of the conoscope to determine handedness and the "squeeze-meter" (amplifying the piezo effect) to determine polarity of the crystals, upper left edges of prism faces corresponding to the major or positive rhombohedra in right handed crystals, normally being positive, negative in left handed ones. However, the conoscope is also rather expensive (\$500) and "squeeze-meters" not readily available. Accordingly, an alternative

II. (nearly) infallible method is that of etching the crystals in a covered hard rubber or pure copper vessel in 52% hydrofluoric acid for a period of at least eight hours. (Note: This corrosive reagent must be handled with the utmost caution, and contact with the skin or breathing of the fumes avoided with care). The prism faces are little affected by this drastic treatment but the pyramid faces become frosted. Examination of the pyramid surfaces by reflected light will disclose shimmering well defined and characteristic etching patterns, not infrequently passing over one or more of the contiguous edges of adjacent faces. Under a 14X magnifying glass, it will be found that the etching pits have one of two orientations either parallel to the prism (m) face edge, which betokens an r (A) or major cap face, and at a steep angle to the prism edge, indicating a z (B) or minor cap face. Both optical and electrical (Dauphiné or 180°) twinning are thus re-

vealed in detail, and in the latter case, it is very interesting to note the instant change of phase as the twinning line wanders over an interfacial pyramid edge. In fact, under favorable conditions, quartz crystals are often sufficiently etched by nature to at least reveal the general distribution of twinning. The last

III. method for identifying r and z faces, though not applicable with certainty in all cases, is of special interest to mineralogists and collectors since it depends in principle on certain rules evolved by observation. The fact that at times the rules may be somewhat controversial makes them none-the-less useful as well as interesting. "Every tool is a little loose in its handle".

It is assumed always that the pyramid of the crystal under discussion is uppermost and upright, faces of the lower or inverted pyramid being reversed in their relative positions:

1. In crystal terminations, *the major r (A) face* so typical of the simple habit of Brazilian, Hot Springs and Ellenville crystals, *not infrequently predominates* giving the characteristic chisel or wedge shape. This r (A) face usually presents an elongated and distorted but easily recognizable hexagon.

2. *The major r (A) faces (usually) terminate the crystal* whereas the minor z (B) faces fall short.

3. *The m (E or F) prism faces corresponding to r (A) faces are commonly tapered*, narrowing towards the top, whereas those of the prism faces corresponding to the z (B) faces are parallel or nearly so.

4. *Two adjacent m (E or F) prism faces may exhibit a noticeable difference of texture* which may be made manifest by:

- a. (Heavier) frosting of z (B) prism faces, the r (A) prism faces usually being relatively smoother and clearer.
- b. Heavier growth lines on z (B) prism faces; those on r (A)

(Continued on page 337)

THE QUARRY AT UPPER MONTCLAIR, N. J.

By HARRY Y. DRAKE

Specimens of stilbite from Upper Montclair, N. J., are widely distributed in mineral collections. Manchester says "The quarry at Upper Montclair was noted for the remarkable red stilbite obtained there". The American Museum of Natural History in New York City has on display several examples of this material (see specimens No. 12921, 12922, 17518), and English has used a reproduction of a photograph of a group of sheaf-like crystals from this locality to illustrate the mineral stilbite in his book "Getting Acquainted with Minerals".

Upper Montclair quarry was located about 1/3 mile northwest of the Upper Montclair station of the Erie Railroad, Greenwood Lake Division. The location can be reached by going west on Bellevue Avenue from the railroad station, turning north on Upper Mountain Avenue to Bradford Road, west on Bradford Road to Edgcliff Road which runs north into the old quarry.

The working was in the face of the First Watchung Mountain which is formed by the exposed edge of a sheet of extrusive basalt of Triassic age. During Triassic time a series of red sandstones and shales were deposited in what is now northeastern New Jersey. The formation of these sedimentary rocks was interrupted by at least three flows of extrusive basic igneous rock. When the system was inclined gently to the west and erosion took place, these lava flows protruded as ridges known as the first and second Watchung Mountains. A number of quarries in the first mountain have produced zeolites and other minerals, notably the West Paterson and Great Notch quarries. Detailed description of the Triassic or Newark formation in New Jersey may be found

in the reports of the Geological Survey of New Jersey, especially the Annual Reports for 1906 and 1907 and the *Pas-saic Folio*.

Originally the Upper Montclair quarry was a source of red sandstone for building known as "Brownstone". As the popularity of this building material waned at the end of the 19th century the basalt, commonly known as trap rock which lay above the brownstone, was worked for road material. At one time the quarry was operated by the late Charles E. McDowell, who became well-known as an authority on the history of Essex County, N. J., and was a pioneer road-builder in this vicinity. In an article on the building stone of New Jersey, J. Volney Lewis wrote in 1908 "Upper Montclair Brownstone — Osborne and Marsellis' quarry in the face of the First Watchung Mountain has produced both brown-stone and trap rock, but only the latter has been worked in recent years". Residential building moved closer and closer until home owners began to complain of the quarry blasting. It was planned to move the operation further to the west and a broad passage was opened through the quarry wall in that direction. Inability to compete with nearby quarries that possessed railroad spurs and continued pressure of residence owners forced the quarry to close in 1918 and it will probably not be reopened.

Not the least interesting feature of this quarry was that here the contact of the extrusive basalt with the red sandstone was well exposed. Plate 116 in Manchester's "Minerals of New York City and Its Environs" shows this contact. The gentle dip of the system of rocks to the northwest might be observed as well as their physical characteristics.

In most instances the minerals found in Upper Montclair quarry were distinctly different from those found at Great Notch and West Paterson in the same

Editor's Note: The quarry is about 300x 150 ft. in size with vertical walls 75 ft. high. Edgcliff Road runs through the center of it.

rock mass and only a few miles further north. Much of the rock in the easterly part of the working was light brownish-red or brown in color instead of the usual gray or greenish-gray and was cut by innumerable veins of quartz and calcite. In places these veins widened into fissures or cavities in which stilbite, calcite and other minerals were developed in crystal form. While Manchester lists 22 mineral species and 10 varieties as having been found at Upper Montclair, stilbite was by far the most prominent specie from the collector's point of view. Although usually described as red the color varied from almost colorless through shades of yellow and buff to deep orange-red, and in occasional specimens true brick-red. Two forms were common: the usual sheaf-like aggregates of crystals and the radiated masses which show like hemispheres on the surface. The sheaves were up to 25 mm across, the hemispheres slightly larger, small crystal groups down to 2 or 3 mm in length were found in many specimens. Least common was the brick-red variety of stilbite. This was seen at rare intervals as slender sheaves about 2 to 10 mm and as hemispherical aggregates. While not a coating, the brick-red color seemed to penetrate the mineral only a slight distance. Whereas the yellow and orange forms were nearly always associated with crystal calcite, the true red was nearly always alone on the rock.

The calcite associated with the stilbite was usually pale amber in color, well crystallized, chiefly of rhombohedral habit. The stilbite was often formed on drusy calcite, and in some specimens larger crystals of calcite apparently of later formation partly enclosed the stilbite. While most of the calcite crystals were from 2 to 10 mm across, in some cases crystals up to 50 mm or more were found. Interesting "butterfly" twins of amber color were occasionally present.

Small crystals of heulandite a few mm long were rather rarely associated with the stilbite.

Quartz in a variety of forms was

plentiful but not in intimate association with stilbite. All shades of amethyst from very pale to rich dark hue were present, and milky and smoky quartz were abundant. One specimen of dark amethyst is sprinkled with clear calcite crystals. In another specimen of pale amethyst with bright crystal terminations, platy crystals of hematite about 1 mm across form a line across the specimen. Much of the smoky quartz collected was sparkling, clean and of fine dark color. Banded agate and chalcedony were met with now and then, the agate being gray, brown and dull red, the chalcedony bluish-gray. Quartz casts after glauconite were also present, some showing shining drusy surfaces others coated with clear calcite crystals.

Some fine dark red chabazite appeared from time to time (see specimen No. 17720 in the American Museum of Natural History collection). A specimen composed of pale green datolite associated with prehnite and dog-tooth calcite is in the author's collection. Pectolite, analcite and apophyllite were occasionally reported, but were not common or of notable quality.

Because the minerals found at Upper Montclair were not only attractive in color but in most species differed also in form and combination from those found at Great Notch and West Paterson they were much sought after by collectors. Some stilbite recently uncovered at the Commonwealth trap rock quarry near Summit, N. J., resembles in form but not in depth of color that found at Upper Montclair.

Literature

"The Minerals of New York City and Its Environs" by James G. Manchester.

"Getting Acquainted with Minerals" by George L. English.

Geological Survey of New Jersey

Annual Report for 1906

" " " 1907

" " " 1908

Bulletin No. 50

Passaic Folio

NEW ENGLAND NOTES

Conducted by Rudolf C. B. Bartsch
36 Harrison St., Brookline, Mass.

Chester, Mass. This famous old emery locality was visited in September by the writer and two other members of the Boston Mineral Club along with Brewster Conant, age 15, of Brookline. Conant is one of the youngest, if not the youngest member of the Rocks and Minerals Association, and owns a very fine collection of minerals. To make the day complete, we were pleasantly surprised with the arrival of Peter Zodiac.

So many times I have heard collectors state that there is nothing to be found on the dumps. I am inclined to agree with these collectors but I will put it this way—there is plenty to be found in the dumps. And so we went to work to get into the dump. The first two feet we went in brought us no specimens but after that the specimen material began to show. Masses of margarite weighing 25 lbs. or over were frequently removed from our excavations. These larger pieces were broken up and thus fine fresh specimens were secured by all, and much good material had to be left behind for others to take at a later date. Interesting radiating groups of hornblende crystals in chlorite schist were quite plentiful. Some talc, emery, and magnetite in good specimens were also taken along. It was voted a very successful trip. All these specimens were collected at the Old Mine on Round Top (South Mountain).

Later in the afternoon we decided to locate three mines in the adjacent Gobbler Mountain (North Mountain). The first one, the Macia Mine, was easily found, but there are no dumps. The working consists of a tunnel that is said to run in straight for 500 feet. Having no flash light we were unable to explore the tunnel which at the entrance appears to be in good condition though very wet. The other two mines, the Sackett and the Snow, we were unable to find but are more anxious than ever to do so another time after hearing of the large dumps from the old timers living nearby. There should be much interesting material here,

when so few collectors are able to find them.

Byron and Houlton, Maine. These two little villages lie in the gold area in Maine and I was fortunate in being able to use them as headquarters for a prospecting trip this past summer for a few days. A three mile walk every morning to the East or West Branch of the Swift River just about limbered us up for the tedious traveling up or down the river, jumping from one boulder to the other or sometimes wading in the icy water. Panning was tried in many places along the banks and in no place did we draw a blank. Every pan showed color and many had sizable nuggets.

As far as I have been able to ascertain, no gold has been reported at any time as having been found in the matrix and considerable has been written on its probable source. We were, however, delighted to find the gold in white quartz in sizable amounts and at a later date some further work will be necessary for a full report on this find.

Gold panning in Maine is mostly crevice working and therefore suitable spots must be worked. Sand and gravel panning do not yield any appreciable amounts of the yellow metal.

Rhode Island. A joint field trip of the Boston Mineral Club and a group of Rhode Island collectors was held this past summer under the leadership of Dr. Alonzo Quinn of Brown University, Providence, R. I. Copper Mine Hill was first visited and some good specimens of copper ores, magnetite, clinocllore, molybdenite, and other minerals were found. Dr. Quinn gave the party an interesting outline of the past history of the old Colonial mine. After lunch the party trekked on to Iron Mine Hill where more material was added to the already heavy loads. The iron ore here is unsuitable for smelting due to the titanium content and the material is crushed and used for road material.

RATE OF WEATHERING OF A SANDSTONE

By K. O. EMERY

La Jolla, California

Because of the scarcity of data on the yearly rate of weathering of rocks the writer has looked for several years for places where actual measurements can be made. One such place is Port Townsend, Washington, where in 1889 a seawall bordering a gravel beach was constructed to serve as a retaining wall for an area of "made" ground. Since the wall faces the harbor, waves are not large and it is only at the very highest tides that water reaches even the base of the wall. The wall consists chiefly of blocks of brown and gray, fine to medium grained, non-calcareous, well consolidated Miocene sandstone. The blocks average about $1\frac{1}{2}$ feet long by 1 foot wide and they are held in place by mortar.

Under old buildings extending over the seawall, the surface of the sandstone is relatively unaltered and is nearly flat and flush with the surface of the mortar. Blocks of the same sandstone found on old buildings of the town are also relatively unweathered except in a few places where there is excessive moisture. However, where exposed along the seawall,

the blocks have a concave surface and stone lace is present on some of them. Loose scab-like peelings of sandstone are present on the surface and are independent of bedding planes. The concavities reach a depth of 1 to 4 inches beyond the mortar surface, which still has its original position as shown by trowel marks.

Weathering of the blocks evidently has not been abrasive in nature because the wall is mostly above sea level and also the loose peelings of rock found on the surface are certainly not the result of abrasion but are indicative of chemical weathering, probably related to wetting of the rock by spray, followed by relatively rapid drying in the sunshine. The removal of rock material to a depth of 1 to 4 inches in 54 years corresponds to an average rate of weathering amounting to 0.02 to 0.08 inches per year or 150 to 600 years per foot. The fresh appearance of the mortar and of blocks of igneous rocks, also found in the wall, indicate an enormously slower rate of weathering for these materials.

SOUTHERN CALIFORNIA LOCALITIES

By JACK SCHWARTZ

656 South Hendricks Ave., Los Angeles, Calif.

13. Riverside City Quarry

Riverside is perhaps one of the prettiest cities in Southern California. The writer likes to think of Riverside as the typical California city. However the weather in Riverside is not at all typical, the summer heat is more than one can stand.

Riverside is naturally in Riverside County. The city is about 10 miles south of San Bernardino City. The quarry itself is in the eastern part of the city.

Riverside City Quarry is famous for its one-locality mineral, namely Vonsen-

ite. Vonsenite is an Iron and Magnesium borate. With this rare mineral Magnetite occurs. The Vonsenite and Magnetite are so similar in appearance that a chemical analysis is necessary to determine them.

Calcite and other limestones are common in the quarry. Very nice crystals of Garnet and Epidote have been collected there. Surely other minerals abound in the quarry but the writer could not find any mention anywhere.

PARICUTIN, THE WONDER OF THE HEMISPHERE!

By PAUL E. KILLINGER

120 W. Winspear Ave., Buffalo, N. Y.

Part 3, As it appeared on July 24th, 1943

On July 24th I decided another trip to Paricutin should be made. (For those interested in philology, Paricutin, is a Tarascan word meaning "across the gully." It was taken from the town of the same name, the destruction of which I described in Part 2).

My companions on this trip were John Hager of St. Louis, Mo., and Jed White, my room mate, from Niagara Falls, N. Y.

We took the train from Mexico City to Uruapan and from there hired a car to San Juan. After the usual extremely rough ride, we arrived at San Juan about 2:30 a.m. I was able to contact the Tarascan who had rented us horses before, and we were thus assured of good mounts and someone to look after them while at the volcano.

Upon sighting the lookout shelter about 3:15 this morning, I immediately remembered that this was not the one that had been used before. When dismounted I found myself correct. The third lava flow, previously described, had almost reached the top of the hill upon which the old shelter stood. The new one is now situated a few hundred feet behind this location and upon a higher hill.

A very awesome scene was presented by the volcano this night. The lava blocks were being hurled to a greater height than ever since its first few weeks of existence. There was an immense quantity of them and they outlined the cone in infinitesimal numbers of glowing points.

The north eastern side of the cone looked like it had been scooped out in some way. There must have been some sort of a sinking action or perhaps a landslide as this whole scar was emitting gasses. As this was the low side of the crater rim, most of the semi-molten

bombs landed in it, making this cup-like depression look for all the world like a flaming cauldron.

Just before dawn we decided to try to get closer. We walked over the hills of the first flow to the rocky walls of the third one. Here we were about three hundred yards from the cauldron-like de-



Paricutin Volcano—from about 500 yards

pression. We found it necessary to keep a sharp lookout, as, now and then, a lava bomb should be thrown high and far enough to be dangerous to us. One whistled down and hit the side of the lava in front of us, exploding and sending a shower of hot rock flying around us. We remained here a few minutes and then moved back a short distance, and finding a suitable spot, dug away some of the gravel and had a very pleas-



Town of Paricutin with the Volcano in background

ant "hot bed" to lie in while watching and awaiting the sunrise.

The sun rose about 5:30, driving the clouds before it, and changing the sky from azure-blue to a delicate green-blue and then to its proper shade of sky-blue. A very beautiful sight which we witnessed at this time was the sun striking the top of the smoke cloud. Its rays made these ascending gasses a mass of swirling, smoky gold. Of all the different times of day and night that I have seen Paricutin, I think that sunrise is the most inspiring. A sunset there is extremely beautiful because of the colors caused by the dust in the air, but these indescribable sunrises seem to induce in me a different state of mind than anything else about it.

On our way back to our horses the wide expanse of the third lava flow

caught my eye to the left. It greatly resembled a small lake of splintered rock.

Thus we have the Third Act of this unpredictable play.

Determination of Faces of Quartz Crystals

(Continued from page 331)

prism faces may be absent or nearly so.

c. More prominent *step growth lines* on *z* (B) *prism faces*, increasing in diameter downwards.

d. *Etching pits or patterns* on *z* (B) *prism faces*.

5. *The long side of s* (C) *faces* (if elongated) *is parallel to the r* (A) *faces*, the lower end pointing to *r* (A) *prism faces*.

ORE MICROSCOPY

By W. R. Jones

Professor of Mining Geology at the Imperial College, London

In this article the author deals with an important branch of research in which British scientists have made some interesting investigations in recent years. Because of its application to recovery of minerals the work that has already been done on ore microscopy is likely to influence future milling operations.

During recent years considerable progress has been made in knowledge of opaque minerals, particularly those of economic importance.

Most metalliferous minerals are not sufficiently transparent or translucent in thin sections to be studied in the ordinary way under the petrological microscope, and so little was previously known of their optical characters that even modern text-books on Mineralogy devote little attention to minerals other than those whose optical properties can be determined by polarized light.

The investigation of opaque minerals requires special technique for preparing polished surfaces of the minerals for examination under the microscope, and a specially designed piece of apparatus, the vertical illuminator, as accessory to the petrological microscope to enable the polished surfaces to be studied under reflected light.

This method of studying opaque minerals is now usually termed "ore microscopy," but in practice includes microchemical tests on selected parts of the minerals removed under microscope control; also the etching of selected parts of the polished minerals to reveal crystallographic structure as an aid to the determination of the species and, in some cases, for supplying information with respect to the relative temperature conditions under which the minerals were formed.

The importance of the information obtained by these methods for the better recovery of minerals during milling operations is briefly outlined in the latter part of this short article. The time is rapidly approaching when mill treatment of certain ores will be formulated, not after unsuccessful attempts on a large scale, but before the process is in operation, as the result of the knowledge sup-

plied to the mill superintendent of the presence in the ore of minerals requiring special precautions.

Well polished surfaces of minerals are essential for their microscopic study by reflected light. The most efficient method known at present of polishing metalliferous minerals is by means of the Graton-Vanderwilt polishing machine which, with skillful use, yields mirror-like polish with the hard and soft minerals in the same plane surface. Other and simpler methods can produce useful polished surfaces but they have the great disadvantage that the hard minerals stand at higher relief than the soft minerals; that the critical boundaries between such minerals cannot be examined under high magnification; and that soft minerals like gold, especially as small grains, are liable to be plucked out during polishing on cloth-covered rotating laps leaving microscopic cavities on the surface.

The principle underlying the construction of the Graton-Vanderwilt machine is that the polishing is done on metal laps run at a slow speed of about 100 revolutions per minute. Cast-iron or copper laps are used for the first stages of the process and lead laps for the final stages. In the latest type of this machine six specimens, rotating on their own axes, are treated together at each stage of the process. Hard minerals, like pyrite, are quickly polished but great care and considerable time (four hours and more in the case of some ore specimens) are necessary to produce a mirror-like polish on soft minerals like galena and others. Experience with this machine in the Geology Department at the Imperial College, London, has shown that the final stages can be much shortened by holding the specimens lightly for a few seconds only

on a rotating lap covered by billiard cloth soaked with water and a little magnesia powder.

The latest types of ore microscopes are fitted with a vertical illuminator (attached between the bottom end of the microscope tube and the objective) which carries a nicol prism as analyzer to give polarized light when necessary. The polarizer is in the microscope tube. The light source is adjusted to reach the aperture of the illuminator in a horizontal direction and it is reflected vertically downwards on the polished surface of the ore specimen by means of a small glass prism which occupies part of the circular space within the illuminator. The prism is so fitted that the light reflected upwards from the specimen misses the prism and travels directly through the microscope tube. By means of a draw-pin, a thin glass disc can be substituted for the glass prism to give a sharper focus for high magnification.

A petrological microscope can be converted readily into a useful reflecting microscope by attaching a vertical illuminator between the tube and the objective. If the light source is mounted to allow a vertical movement of two to three inches, it can be brought to the right position relative to the aperture of the illuminator, and the specimen focussed in the usual way.,,

It is of prime importance that the polished surface should be perpendicular to the incident light. This assured by levelling the specimen on plasticine on a glass slide either with the "ring" method or, easier, with a small levelling instrument supplied by makers.

Even with ordinary reflected light, a great deal of valuable information is revealed under the reflecting microscope from the polished mineral surfaces. Some minerals frequently show alteration in parts to secondary minerals; apparently pure minerals are seen to contain minute disseminated grains of other minerals; the grain size of the different mineral constituents can be measured accurately; the earlier formed minerals may show fractures filled with later minerals; and much other evidence is obtained

concerning the paragenesis of the minerals composing the ore.

With reflected polarized light, many opaque minerals display optical phenomena of definite diagnostic value, thus making it possible to determine the species of even minute grains. Two or three examples will serve to illustrate this. The sulphide of copper mineral, covellite, is pleochroic under reflected light, changing in parts from very pale blue to deeper blue on rotating the microscope stage; and with the nicol prisms in almost crossed position, covellite shows characteristic polarization colors ranging from light and darker blue to carmine red. Thus small grains of this mineral are readily recognized by these optical tests.

Marcasite and pyrite, two minerals of the same chemical composition, are notably difficult to differentiate as grains by any means other than by reflected polarized light when it can be done by simply rotating the stage. Whereas pyrite is isotropic, marcasite shows polarization effects, the colors being shades of browns and greens. Arsenopyrite gives pale yellow and sky blue colors; antimonite shows multiple twinning in the form of purplish brown and grayish white bands, and many other examples of the diagnostic value of this method could be cited.

Space does not permit a description of the modern methods employed in the investigation of opaque minerals by microchemical and by etch tests, but to conduct even these tests, well polished surfaces are necessary to avoid the many errors which resulted formerly from the interpretation of chemical analyses of apparently pure minerals and gave rise to supposed new mineral species which, in fact, were later proved under the ore microscope to be intimate mixtures of two or more minerals. With well polished surfaces, and under microscope control, parts of the pure mineral to be tested microchemically can be carefully removed; and the reagent, for etch tests, can be applied to selected parts of the mineral where it is free from minute inclusions.

A very brief outline will now be given

of the applications of ore microscopy to milling problems in gold mines, in order to illustrate its practical value to the mining industry.

It is well known that even in mines in the same gold field, the ore may be markedly different not only in its gold content but also in such important aspects as the grain size of the gold and its mineral associates, with the result that there is less in the percentage recovery of the metal unless precautions are taken with the ore containing troublesome minerals.

Milling operations are concerned with minerals, not the elements of which they are composed, and hence chemical analyses frequently fail to supply the mill superintendent with much of the information to enable him to improve the percentage recovery. For example, the three common simple sulphides of iron, pyrite, marcasite, and pyrrhotite are chemically similar but marcasite and pyrrhotite are usually much more trou-

blesome as cyanicides in gold recovery than is pyrite. These three minerals are easily distinguished from their polished surfaces under reflected polarized light, and cases could be cited where information concerning the unsuspected presence of marcasite and pyrrhotite has led to much improved recoveries of the gold.

In some auriferous ores almost all the gold is present in grains so small that it is invisible to the naked eye and can only be detected when highly polished surfaces of the ore are carefully examined under high magnification. Such gold may be intimately associated with one or two of the many minerals in the ore so that the flotation process should be adjusted to prevent loss of those particular minerals, rather than the others which may be barren of gold.

Recent methods of obtaining information about opaque minerals are not only of great scientific interest, but lead also to milling improvements of considerable economic importance.

THE KASAI DIAMOND FIELDS AND THEIR MINERALS

By HORATIO C. RAY

San Juan, Puerto Rico

The Kasai Diamond fields are located in Belgian Congo along the Kasai River (the largest southern tributary of the Congo River) and its tributaries. The principal mines lie between the Tshikapa and Lulua Rivers (west to east) and from the Angola border to the junction of the Tshikapa and Kasai rivers. Old maps, which were mostly of Portuguese origin, call Tshikapa, Chikapa. Tshikapa, which is the administrative headquarters of the company, and also an administrative post of the government, is found at the junction of these two rivers, the two posts lying across the Kasai River one from another.

The mines are all placer, that is, the diamonds are found in gravel deposits in and along the beds of the present creeks and rivers. The bulk of mines are found along the small creeks. Some of the larger mines are 'flats', that is, gravel left

behind by the gradual change of the river bed. These are along the larger rivers. Some of the creeks have been worked for a distance as great as 25 kilometers (approximately 15 miles), but they probably average about 10 kilometers. As a rule, the size of the diamonds increases towards the source but this is not always the case and good sized stones are found throughout the length. The average stone size varies with the deposit. In a general way, the finer the gravel, the smaller the stones.

The immediate source of the diamonds in this region is a sandstone-conglomerate. This expression is used because the bulk of the rock is sand grains but it contains some gravel as well. The ultimate source of the diamonds is a volcanic material very similar to that in which the diamonds are found in South Africa, there known as 'kimberlite'. In

some of the more southerly of the mines and many of Angola, this volcanic rock forms the 'bedrock' of the mines, the sandstone if it ever existed having entirely disappeared. In spite of the great movement to which the gravels have been subjected (they are very well rounded) the diamonds show not the least sign of abrasion and some are as bright and clear as if they had just been molded out of glass and polished. Indeed, they resemble new glass greatly, but their luster makes them stand out along side of quartz, for example, like a 100-watt electric lamp along side a candle.

Mineralogy

The same minerals are common to all the mines though the proportions of the different ones vary greatly. The principal mineral is, as would be supposed, quartz. The following varieties have been noted: Clear, milky, smoky, chalcidony, amethyst, chert, agate and jasper. Others doubtless exist. The following minerals are common: garnets, ilmenite, magnetite, black tourmaline, staurolite, cyanite. Most of these minerals are in form of sands which rarely pass $\frac{1}{8}$ inch in diameter. Occasionally pieces as large as $\frac{1}{2}$ inch are found, but these are most-

ly black tourmaline, staurolite, and magnetite. The importance of the minerals is about as listed above, although this varies greatly. I remember several mines where nearly all the "black sands" are made up of a bright red garnet, of jewel quality if sufficiently large. At others ilmenite is the principal mineral and there is one section where cyanite is the principal mineral and gives a great deal of trouble in the picking station.

Of course, the prize mineral is the diamond itself. Its beautiful crystallization, the play of colors (even before it is cut) and its smooth unscratched faces makes it a beautiful mineral. Sometimes you have multiple twinning on the faces of the crystals but this is the exception rather than the rule. One can often distinguish within them the "crapauds", the imperfections, in the form of black solid fragments; cavities (either empty, gas-filled, or liquid-filled), and small cracks. One can usually tell by looking at the raw stones the general class into which it will fall when cut, although cutting often brings out a higher "water" to an inferior stone. Colored stones of jewel quality are rare in the Congo. I saw one or two 'canaries', (clear yellows), and one beautiful green one.

COLLECTORS' KINKS

"HOW TO DISPLAY QUARTZ "DIAMONDS"

By GUNNAR BJARBY

Most of us have some of the clear and doubly terminated Quartz crystals from Montgomery and Herkimer counties in the State of New York. The well-known term "Herkimer Diamonds" is really a misnomer unless the crystals are properly displayed. If you want your 'Montgomerys' and 'Herkimers' to do justice to themselves, and actually compete with real diamonds for a beau-

tiful display of colors, place them at best possible advantage on a piece of mirror glass under or near at least two points of light. After a few experiments, one soon finds the most favorable place on the shelf. The result is an astounding display of all colors of the spectrum. It is taken for granted that most up-to-date collectors have their cases wired and well lighted.

With Our Dealers

W. Scott Lewis, of Hollywood, Calif., took time out from his business to go on a little vacation trip. Now greatly refreshed, he is working harder than ever to catch up with his many mineral orders.

Hartman Trading Co., of New York, N. Y., who have been in business for many years, specializing in gem stones and carvings, have branched out as dealers in minerals. They have an excellent start—since they have acquired the entire famous stock of minerals from Major Martin L. Ehrmann of the U. S. Army.

Would you like an exceptional amethyst specimen for your collection? Schortmann's Minerals, of Easthampton, Mass., have such a specimen for sale. Read their ad. It's just the specimen for you! Order it today!

Warner & Grieger, of Pasadena, Calif., have scored another scoop—in the purchase of the noted crystal collection of the late Chas. W. Hoadley, of Hartford, Conn. You will be scoring a scoop, too, if you order some of the crystals!

It is time to be thinking of Christmas! So says Chuck Jordan, of Los Angeles, Calif., in his advertisement. He is right. Don't wait until Dec. 15th to buy your presents. Buy them now and hold them. But what to buy? Don't worry. Jordan relieves you of this anxiety. Just read his ad and start ordering!

V. D. Hill, of Salem, Ore., reports a heavy demand for his new catalog. Are you on his mailing list? If not, rush in your name and address for a copy of his attractive 32-page catalog while his supply lasts. His offerings are as attractive as is his catalog!

John A. Grenzig, of Brooklyn, N. Y., announces the arrival of the finest and largest stock of rock crystals from Arkansas to reach him in years. Reach down into your pocket for a couple of dollars and have one of these fine specimens reach you!

Ward's Natural Science Est., Inc., of Rochester, N. Y., announce the acquisition of some unique scheelite crystals from California. It would not be unique but good judgment on your part to order one or several of them!

Nodules are always interesting and in demand so it is good to know that one of our advertisers has a large stock of them. West Coast Mineral Co., of La Habra, Calif., are featuring some good varieties in this issue. Better order some of each before their stock is exhausted!

Two superb gold specimens from the famous Breckenridge, Colo., locality are offered this month by E. Mitchell Gunnell, of Denver, Colo. Order them both and then you will have two superb gold specimens in your collection!

Club and Society Notes

Bridgeport Mineral Club

Mr. Ernest M. Marshall, of Bethel, Conn., who has been reelected President of the Club, made this announcement recently:

Murray Perkins, one of the young men of the Bridgeport Mineral Club, is in the Air Corps. He is our keenest youngster. He passed for pilot, bombardier, and navigator—he chose the latter. While on a practice flight (somewhere in the West), he had to pick out objectives on the map, where he had never been before, and spot them a mile or two up from the plane. Naturally he selected mines and dumps. Murray Perkins never thought he would go mineral hunting so high up! Worse of it all, he said later, he never got any specimens!

Rochester Academy of Science

(Mineralogical Section)

A regular meeting of the Section was held on Thurs., Oct. 14, 1943, at 8:00 p.m., at the Bausch Hall, Rochester Museum of Art and Science, East Ave., Rochester, N. Y.

The business end of the meeting was devoted to (1) Action on affiliation with the R. & M. A.; (2) Arrange program for 1944; (3) Augment collection of Monroe County minerals.

The regular program consisted of a discussion on minerals and localities of Italy. All members attending brought Italian specimens to the meeting.

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